

EFFECT OF ORGANIC SOIL AMENDMENT AND SOIL SOLARIZATION ON WILT OF CHICKPEA

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ABSTRACT

A field experiment was conducted during 2012-2013 at SHIATS, Allahabad (U.P.). To compare the effect of organic soil amendment (FYM, Vermi-compost, Green manure, Neem cake) and Soil solarization against fusarium wilt of chickpea. Results revealed that among all the treatments with soil solarization were more effective in controlling wilt disease of chickpea (54.4%) as compared to Neem cake (46.7%), Farm Yard Manure (39.9%), Vermi compost (39.3%) and Green manure (26.2%). Shoot and Root growth also increased in above treatments as compare to control. Yield percent is highest in soil solarization *i.e.*, (15.90 q/ha) however CBR shows that Vermi compost @ 10 ton/h economically cost benefit treatment (1:1:54).

KEYWORDS: Organic Soil, Soil Solarization, (FYM, Vermi-compost, Green Manure, Neem Cake), *Cicer arietinum L*

INTRODUCTION

Chickpea (*Cicer arietinum L.*) is an important pulse crop and India ranks first in the world as per the latest report of Food & Agriculture Organization (FAO) for 2011, India is the largest producer and consumer of chickpeas in the world. Most production and consumption of chickpea (95%) takes place in developing countries. It was grown on about 11.9 million hectares in 2010. While in 2012-13 (second advance estimates) record production of chickpea is 8567.8 thousand tone. 50 different pathogens have so far been reported on chickpea [12] including diseases caused by fungal, bacterial, nematodes mycoplasma and viral pathogen. Chickpea is frequently attacked by a wilt caused by *Fusarium oxysporum f. sp. ciceri* which is worldwide in distribution. The chickpea wilt caused by *Fusarium oxysporum f. sp. ciceri* was reported to be widely distributed in near about 32 countries of the world and at national scenario; six fungal diseases have been reported to be important and causing considerable damage to the crop [6, 12]. The fungus causes severe yield loss in chickpea: in India it is 10–15%, which in years of severe epidemics may rise to 60–70% [7]. Organic amendment is a common practice adopted by the farmers as they are not accepted the synthetic chemical fertilizers for its hazardous effect. Organic amendments are recommended as biological means to reduce the incidence of several soil-borne plant pathogens also Soil solarization is an effective method to control soil-borne pathogens in tropical and sub tropical areas. Soil solarization involves the use of transparent polythene mulch for capturing solar energy for heating the soil for controlling pathogen in the soil [10]. Thus the present investigation were carried out to find out the effect of organic manure that is farm yard manure, vermi compost green manure and Neem cake in suppressing wilt of chickpea effect of soil solarization was also observed.

MATERIAL AND METHODS

Experiment Detail

Field trial was conducted during 2012-2013 at wilt seek field located at SHIATS, Allahabad on local variety (K-850) of chickpea. The site of experiment located at 25.87° N latitude and 81.54° E longitude and 98 m above sea level this region has sub tropical climate with extreme of summer and winter. During winter season, especially in the month of December to January the temperature drops down to as low as 2° C and during summer it reaches up to 48° C. In laboratory all glass ware are washed dried and sterilized at 160°C for 2 hrs and PDA (potato dextrose agar) used for isolation of fungus as described by [1]. For isolation of fungi infected plants of wilt disease were cut into small pieces 2 mm surface sterilized by 0.1% mercuric chloride rinse 3times by sterilized distilled water and isolated into petriplates containing PDA medium and incubated at 25°C after weak hyphal tip from colony is transfer to the another petriplates containing PDA to get pure culture. Identification of the pathogen was confirmed by referring relevant literature. Pathogenity test and multiplication of fungus was done as per method of [13]. Infected field were prepared before treatment by inoculation of mass culture of pathogen to soil. Soil solarization was done during the hottest summer month (April to May) using transparent polythene sheet (400 gauge) for 45 days, polythene sheet lade on trial field in such a way that there was no air gap. Soil was placed around the edges each polythene sheets. Polythene was removed after 45 days of solarization. For Green manure, Diancha (*Sesbania aculeate*) was sown before 2 month and was ploughed 2 weeks before sowing of seeds in the plot. Organic amendment such as Farm Yard Manure @ 10 t/h, Green manure Diancha (*sesbania aculeate*) @ 3t/h, Vermi compost 10 t/h, Neem oil cake 5t/h and soil solarization. The experiments was laid out in randomized block design with three replication plot size 2x2 m² was prepared, 3 plots are without any treatment was taken as control. Seeds were sown with spacing 30 cm within rows. All plots were hand weeded twice (at 3rd and 7th week after planting). For disease assessment the percentage disease incidence was calculated by dividing the total number of plants infected by the disease by total number of plant observed multiplied by the 100. Disease severity it was measured using the severity rating scale on 9 point scale in percentage and plant growth parameter, yield and CBR was also calculated.

RESULTS AND DISCUSSIONS

The incidence and severity of wilt disease was reduced to some extent in all the treatments over control and statically were significant to each other. The data shown in(table 1): revealed that Soil solarised plot gave maximum disease control i.e. 54.4% compare to control followed by Neem oil cake (46.7%), Vermi compost (39.38%), Farm Yard Manure (39..9%) and minimum in Green manure (26.2%). [3] Reported that Soil application of green manure, mustard cake and farm yard manure lead to significant reduction of population of *Fusarium oxysporum* f. sp. *ciceri*, causal agent of chickpea wilt under field condition. These observations support the present findings. At depth of 15 cm with increase in temperature the effectiveness of soil solarization in controlling wilt diseases over control was due to increase in soil temperature (45°C) below the polythene sheet which is the lethal range of many microorganisms [14]. The increase in soil temperature by 7.7° C by solarization has been considered as the major driving force for various biological changes in the soil [9]. [4] Also reported the increase in soil temperature using soil solarization. [15] Conducted field experiment to study the effect of soil solarization for the control of *Meloidogyne incognita* and *Fusarium oxysporum* f. sp. *ciceri* by covering the soil by transparent polythene sheet for 6 week during hot summer months. Result showed that increase in soil temperature caused significant reduction of population of *Meloidogyne incognita* and *Fusarium oxysporum* f. sp. *ciceri* to

58.1% and 80.8% respectively. The availability of soil nutrients were increased by soil solarization while the physical and chemical characteristic of soil remains unchanged.

The growth (table 2) shoot and root length in soil solarization (48.04, 10.83) was the highest as compared to other treatments, where as dry shoot weight is higher in Neem oil cake(3.89) and dry root weight is maximum in Vermicompost (1.26). Yield (table 3) obtained was similar to the effectiveness of treatment *i.e.* maximum in Soil solarisation(15.90) followed by Neem oil cake @ 5t/h > Vermicompost @ 10 t/h > Farm Yard Manure @ 10 t/h > Green manure > Control, Other researchers [5, 8, 17] also reported beneficial effect of Vermicompost, FYM and Green manure on the growth and yield of chickpea. These finding are in conformity with the findings of [16] in chickpea, mungbean and [11] in French bean. Cost benefit analysis (table 3) of all the treatments revealed that organic manure 10 ton/h shows maximum CBR (1:1.54) whereas, farm yard manure @ 10 t/h gives 10,010 rupees net profit per hectare these results are in accordance with the findings of [2] in soybean.

CONCLUSIONS

Hence, the result of present study demonstrated that application of organic manure (FYM, Vermi compost, Neem oil and Green manure) and other alternative practice (Soil –Solarization) for soil treatment is quite promising approach for eco friendly management of Chickpea wilt disease caused by *Fusarium oxysporum* f.sp. *ciceri* and helps in enhancing growth and yield of chickpea. It is also economical and beneficial with soil improvement point of view.

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Table 1: Effect of Organic Amendment and Soil Solarization on Wilt Disease of Chickpea

Treatment	Disease Incidence (%)	Disease Severity (%)	Disease Control (%)
FYM @10 t/h	54.8	27.7	39.9
Green manure@ 3t/h	68.5	39.4	26.2
Vermicompost @ 10 t/h	55.4	28.8	39.3
Neem cake@5t/h	48.0	26.6	46.7
Soil solarization	40.3	23.4	54.4
Control	94.7	86.4	-
SEM ±	1.68	1.2	-
CD (P = 0.05)	2.37	3.59	-

Table 2: Effect of Organic Amendment and Soil Solarization on Chickpea Growth

Treatments	Shoot Length	Root Length	Shoot Weight	Root Weight	Dry Shoot Weight	Dry Root Weight
FYM @10 t/h	44.62	8.10	36.11	3.25	3.55	0.46
Green manure@ 3t/h	46.21	9.10	30.77	3.15	3.10	0.92
Vermicompost @ 10 t/h	44.91	9.38	30.31	3.93	2.82	1.26
Neem cake@5t/h	44.51	10.6	42.82	3.80	3.89	1.07
Soil solarization	48.04	10.83	43.24	4.26	3.08	0.09
Control	42.22	7.33	20.25	3.14	2.73	0.63
SEM +	1.36	5.3	1.75	0.24	0.25	0.20
CD (P = 0.05)	1.13	0.89	5.24	0.60	0.76	0.28

Table 3: Economic and Cost Benefit Ratio of Treatment in Chickpea

Treatment	Yield (q/ha)	Increased in Yield Over Control	Net Profit (ha)	Cost Benefit Ratio
FYM @10 t/h	11.0	2.67	10010	1:1.50
Green manure@ 3t/h	9.83	1.5	5990	1:1.32
Vermicompost @ 10 t/h	11.60	3.33	9600	1:1.54
Neem cake@5t/h	14.75	6.42	6670	1:1.28
Soil solarization	15.90	7.57	4450	1:1.42
Control	8.33	-	-	-

